ANNUAL CHANGE OF INDIVIDUAL NUMBERS AND NEST SITES OF THE MARKED ADÉLIE PENGUINS IN THE ONGULKALVEN ROOKERY

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Abstract: As a part of the ecological studies on Adélie penguin, the banding was performed by the present author. 55 adult penguins were marked at the Ongulkalven rookery between 17 and 20 January 1972. The observation of the homing behavior of the marked birds has been continued till the present by the personnel of the Japanese Antarctic Research Expedition. The results obtained till 1977 austral summer are described in the present paper.

The individual number of the marked birds which returned to the rookery decreased at a constant rate of about 38% annually and diminished to four birds in the summer of 1977. The age of the four birds was over 7 years old.

The nest sites of 29 individuals out of 55 marked birds were identified in 1972. Out of the 29 birds 17 returned to the original nests in the 1972–73 breeding season. The affinity of Adélie penguin to the area around the original nest site is firm. However, the returned birds do not always strictly prefer the original nests. The removal between the rookeries adjacent to each other was observed. But the number of marked birds found in the neighboring rookeries was three out of 55 between 1972 and 1977.

1. Introduction

Bird banding is one of the effective methods to investigate the population dynamics and the behavior of the birds. Many reports on the penguin banding have been published (SLADEN, 1952; AUSTIN, 1957; SLADEN and TICHELL, 1958; SLADEN and PENNEY, 1960).

In the area concerned with the Japanese Antarctic Research Expedition, more than one thousand banded birds of Adélie penguin, *Pygoscelis adeliae* were released before the present investigation. Unfortunately, however, the banding was not carried out systematically and the follow-up observations were insufficient to get conclusive results. In order to fill the gap in the penguin study in the Syowa Station area, the writer attempted to band as many birds as possible and to monitor the homing birds in the successive seasons.

As a member of the biological team of the 13th Japanese Antarctic Research

Expedition (JARE-13), the present writer investigated the behavior of Adélie penguins in the Hinode, the Ongulkalven, the Mame-zima and the Rumpa rookeries (HOSHIAI and MATSUDA, 1979). Banding was performed by the writer at the Ongulkalven rookery between 17 and 20 January 1972. The observations on the homing of the marked individuals have been continued with the co-operation of the JARE personnel.

In the present report, the writer outlines the results obtained on the banded birds until the austral summer of 1977.

Ongulkalven is a small island lying at 69°01'S, 39°26'E, about 6 km WSW from Syowa Station (Figs. 1 and 2). In summer the island becomes ice-free for the

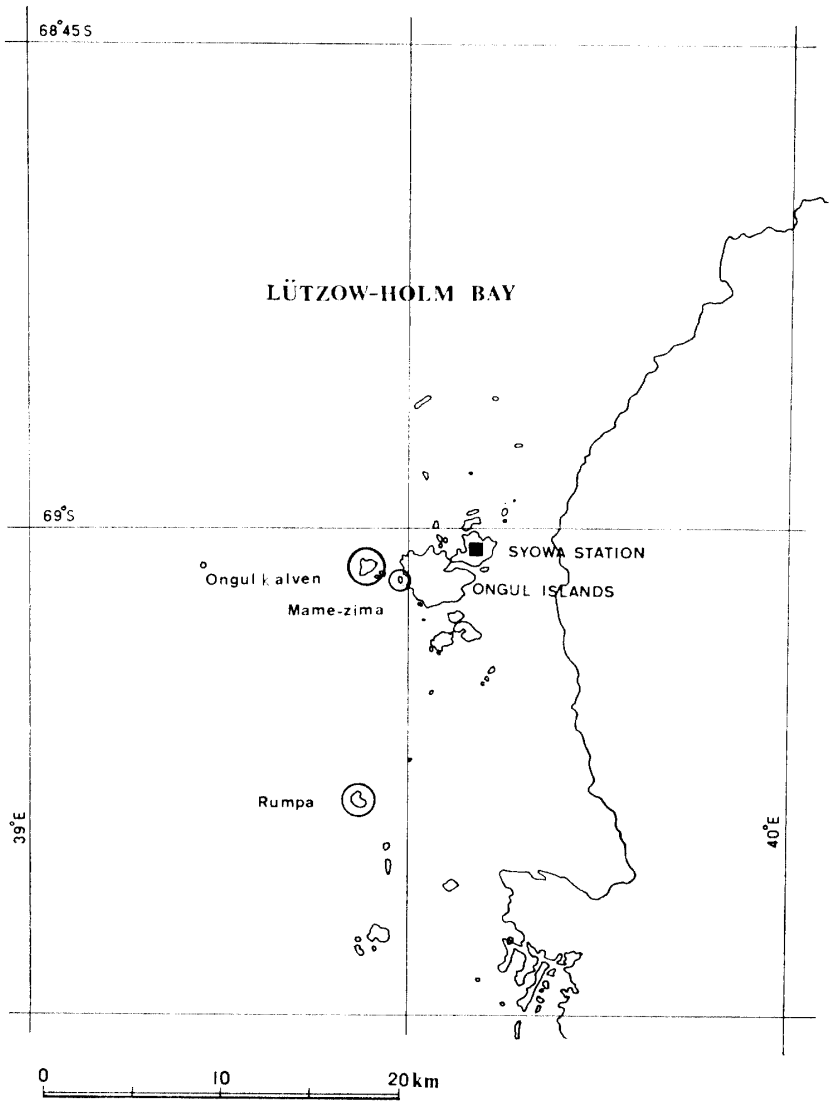

Fig. 1. Map of the Syowa Station area.

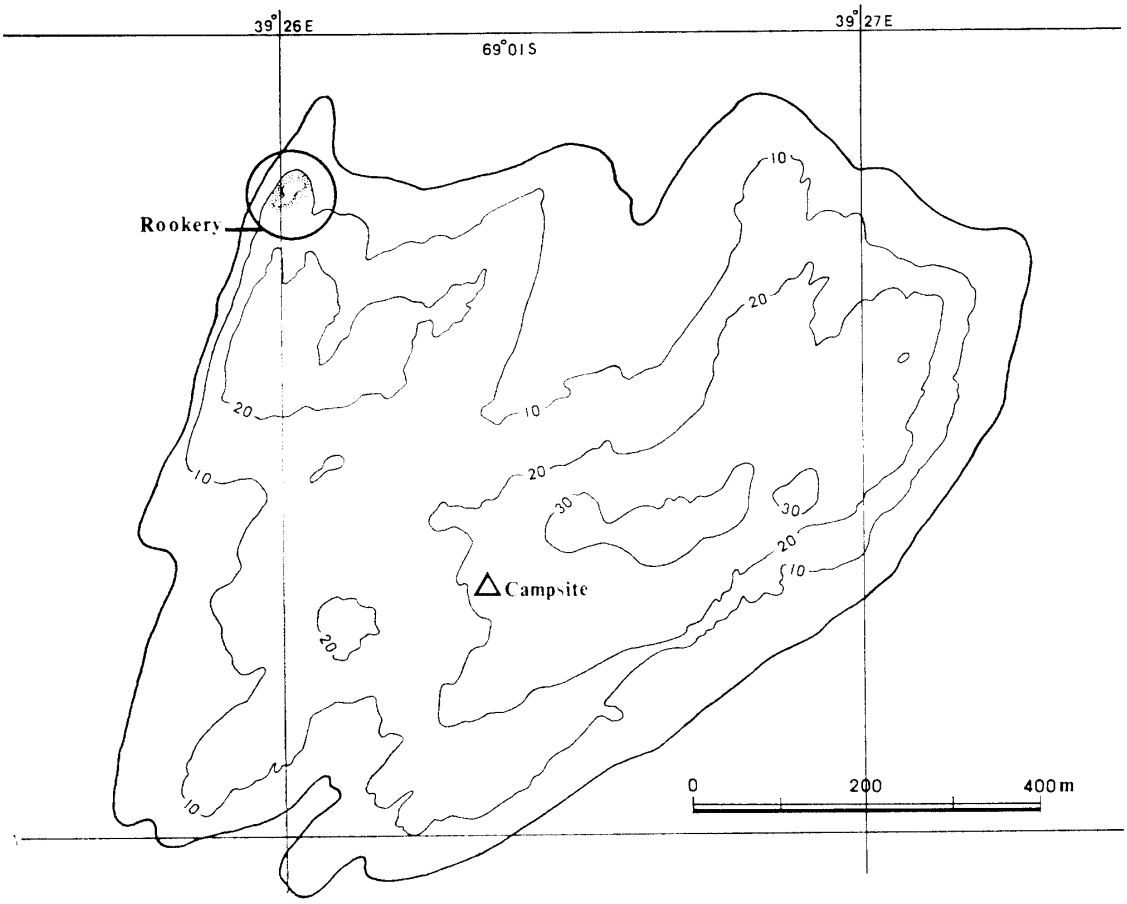

Fig. 2. The Ongulkalven rookery. Contour interval: 10 meters.

most part. The rookery studied is located on the northern slope of a projection at the northwestern edge of the island. The rookery is composed of three colonies which are situated at 12 m to 16 m above the sea level (Fig. 3). Colony A was on the lower terrace, which was a bare rock about 1.5 m wide, divided into two parts, east and west. Colony C was on the upper terrace. Colony B was located on the slope between A and C, where only one pair had their nest. This is the only rookery in the island.

MATSUDA (1964) studied the life of the Adélie penguins in this rookery. According to him, Adélie penguins come back to the rookery after 20 October and they begin to lay eggs from the middle of November, and their eggs are hatched out at the end of December. The number of adult birds reaches a maximum in early November, making the first peak, which is named the occupation period by SLADEN (1958). The number of birds decreases when females go away for feeding after they finished laying eggs, and the number is reduced to half by the end of November. In January as adult birds return as well as young adults, the number

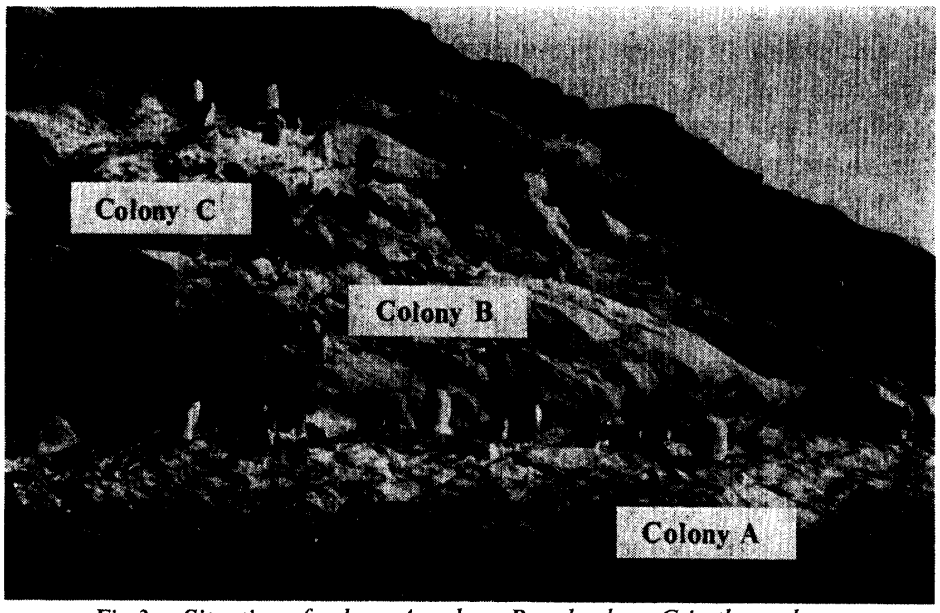

Fig.3. Situation of colony A, colony B and colony C in the rookery.

of individuals begin to increase again to attain the second peak, the reoccupation period by SLADEN (1958). This fluctuation of the bird number in a breeding season coincides with the results obtained in Signy Island (SLADEN, 1953) and in the Wilkes Station area (PENNEY, 1968). Therefore, it is said that the fluctuation of bird number observed in the Ongulkalven rookery is agree with the general tendency in population fluctuation of Adélie penguin in the breeding season.

The maximum individual number of penguin was 110 in the 1961–62 breeding season (MATSUDA, 1964). The birds were 113 on 13 November 1971 (WATANUKI, personal communication). Accordingly it is considered that no remarkable change in the population size occurred in this rookery during about 10 years before the present banding.

2. Materials and Methods

Materials previously used for banding are metal bands of aluminum and stainless steal, celluloid bands and strings. Celluloid bands and strings are useful as well as the painting marks for the short-term ecological and ethological researches and the metal bands, especially aluminum bands, are suitable for the longterm researches. The stainless steal bands are easy to band but also easy to slip off (HOSHIAI, 1971).

Thigh, tarsus or flipper are selected for the position of banding but tarsus is inappropriate because it is easily injured making it difficult to find the band later. Thigh band are inconvenient because they would be covered by feathers. Furthermore, it is difficult to read the numbers on the bands unless the birds were captured.

The flipper bands are easily recognizable even if the birds are distant from the observer and no matter what postures they may take in the rookery. PENNEY (1968) reported that the numbers on the flipper bands could be read easily with 6-power binoculars from a distance up to 12 m or with 20-power scope up to 30 m. Therefore, in the present investigation the aluminum flipper bands were used. In the case of the flipper bands used in this study the numerals could be read clearly with 7 power binoculars from a distance up to 8 m.

The aluminum band used is 180×10 mm in length and 1.5 mm in thickness and is folded double. It bears the letters of JARE WRITE TOKYO, JAPAN and a number of four figures. For the convenience, serially numbered bands were used.

Banding operation is illustrated in Fig. 4. The writer placed a bird's head between his knees with the heels touched in order to prevent the bird from the slipping away, and put a band on the left flipper. PENNEY (1968) illustrated the same method by the photograph. Incubating birds are obedient if they are treated gently by covering their head with a hat. However, non-breeders were so active that they needed to be caught with a net.

Fig. 4. Holding a penguin for banding.

3. Results and Discussion

55 adult birds, 16 chicks and one egg were found in the Ongulkalven rookery during the period of banding between 17 and 20 January 1972. Based on the observation of behavior of the birds, the 55 adults were classified into the following three groups, the established breeder, the unestablished breeder and the non-breeder, according to the criteria proposed by SLADEN (1958). 1) Established

breeder; the birds which keep the stable partnership, lay eggs and breed chicks. 16 birds, 8 pairs belonged to this group. 2) Unestablished breeders; the birds which one of the pair has a nest and settle down but its partner is changed frequently. 12 birds were assigned to this group. 3) The birds which wander about to change the partners, make nests but do not settle in a certain nest, copulate but do not lay eggs. The other 27 birds were included in this group.

The band numbers of the marked birds are given below in each of the three groups. Sexuality of the birds could not be distinguished.

1) Established breeders; (0012, 0050), (0016, 0052), (0017, 0047), (0019, 0040), (0023, 0033), (0024, 0046), (0025, 0044), (0032, 0063).

2) Unestablished breeders; 0015, 0018, 0030, 0031, 0043, 0045, 0048, 0053, 0061, 0062, 0064, 0065.

3) Non-breeders; 0011, 0013, 0014, 0020, 0021, 0022, 0026, 0027, 0028, 0029, 0034, 0035, 0036, 0037, 0038, 0039, 0041, 0042, 0049, 0051, 0054, 0055, 0056, 0057, 0058, 0059, 0060.

The records of reappearance of the marked birds in the rookery in five consecutive breeding seasons are shown in Fig. 5, in which the records of the three birds found in the neighboring two rookeries, the Mame-zima rookery and the Rumpa rookery (Fig. 1) are also included. In Fig. 5 the birds actually recognized in the rookery are shown by the solid bars. The dotted lines between the solid bars mean the possible residence of the bird in the rookery at a certain period during the breeding season concerned. Although a few birds which temporally removed into other rookeries might have been counted as the possible residents, in this report the

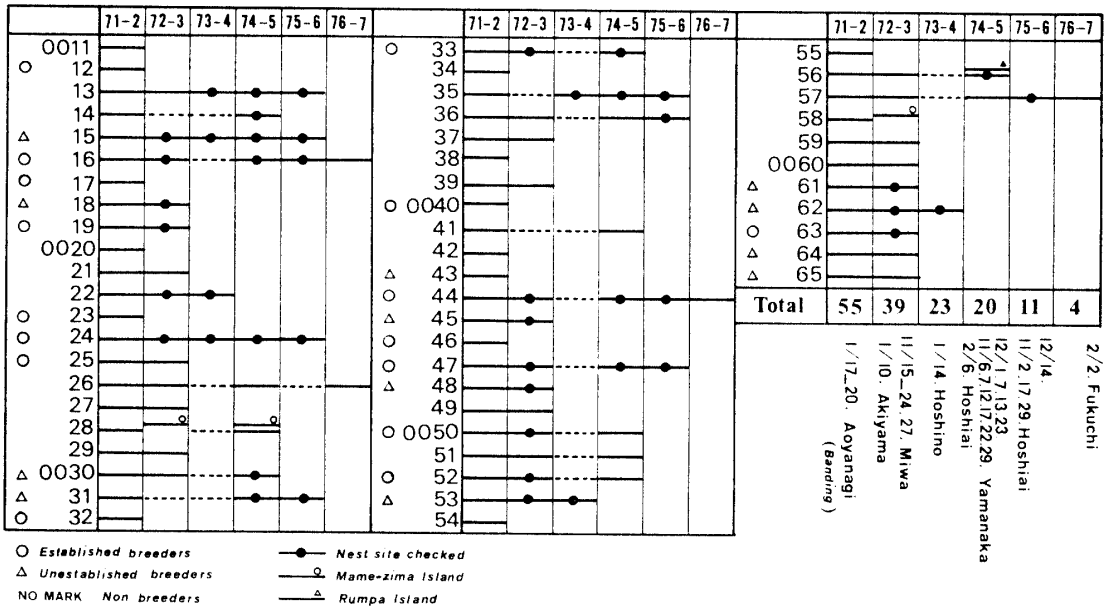

Fig. 5. Records of reappearance of the marked Adélie penguin in the Ongulkalven rookery.

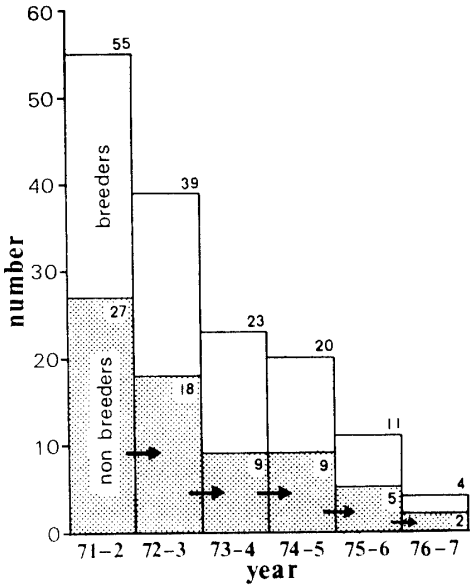

Fig. 6. Annual change of the number of marked birds which returned to the Ongulkalven rookery.

possible residents are included in the number of the returned birds. In this connection, it should be taken into account that the proportion of the possible residents in the total number of returned birds is high in the 1973–74 season due to the lack of the November observation.

As shown in Figs. 5 and 6, the number of the marked birds discovered in the rookery decreased annually at a constant rate. DEEVEY (1947) pointed out that the mortality of the adult birds after leaving the nest is commonly constant every year. RICHDALE (1959) showed that the death rate of the full-grown individuals of yellow-eyed penguin, *Magadyptes antipodes*, did not indicate any meaningful difference annually. It seems that the mortality of Adélie penguin coincides with the suggestion of DEEVEY (1947). The number of the breeders and of the non-breeders was equal in the 1971–72 season when the banding was performed. Thereafter, the proportion between them had not changed until February 1977 in spite of the decrease of the reappeared bird number.

SLADEN (1958) reported that the age of the non-breeders was two or three years old and the majority of them were two years. Therefore, assuming that the non-breeders in the Ongulkalven rookery were two years old in 1972, two out of the four marked birds were 7 years and the rest were 8 years or older. On 2 and 3 January 1972 two marked Adélie penguins were discovered in the Hinode rookery. Referring to the records of JARE bird banding, it was ascertained that one of them was banded in Ongulkalven and the other was marked on the sea ice of Lützow-Holm Bay in January 1960 by the members of JARE-4. If the two birds were two years old at that time they have become 14 years old in 1972. When

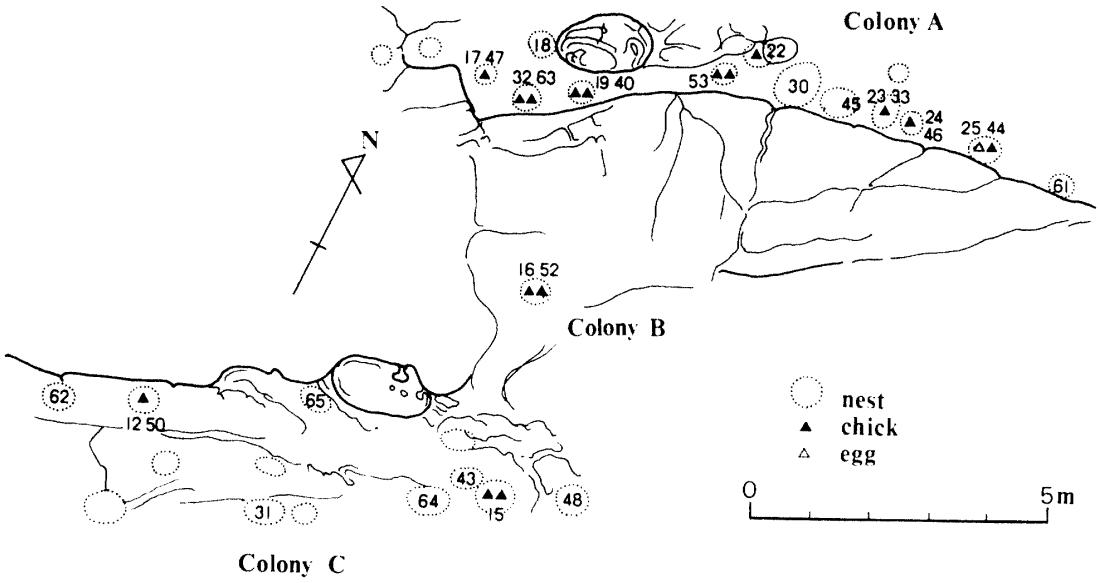

Fig. 7. Distribution of the nest and its residents in January 1972.

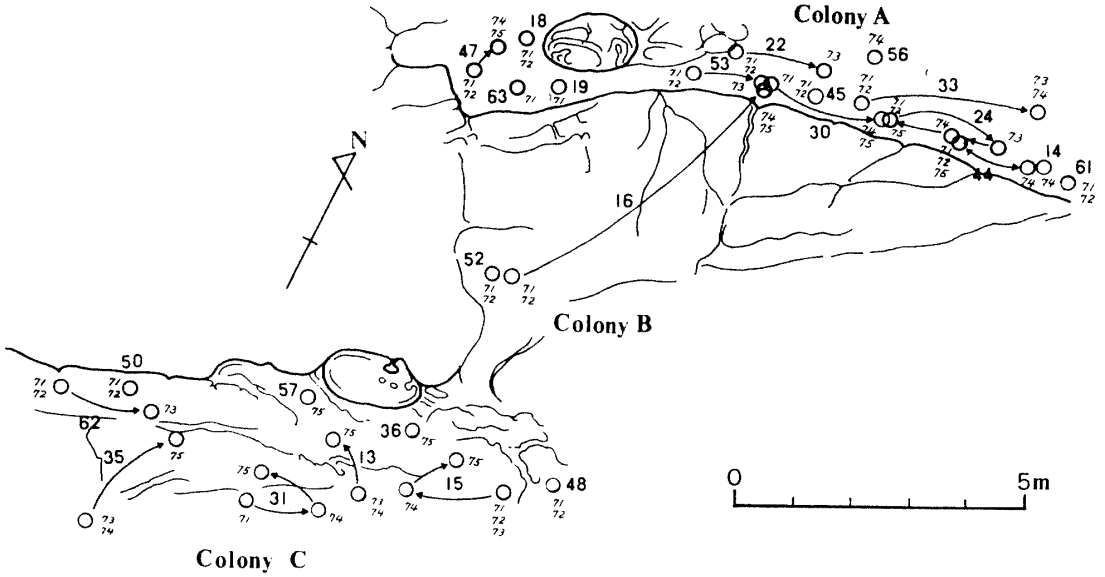

Fig. 8. Nest sites occupied by the 25 marked birds between 1972 and 1977.

recovered the both birds were incubating eggs (AOYANAGI, 1973). Although it is difficult to show the exact life span of Adélie penguin from the data mentioned above, the data would be useful for further discussions on this problem.

In February 1972, 21 nests were occupied by the 29 marked birds, which were composed of 16 established breeders, 12 unestablished breeders and one non-breeder and their positions in the rookery are mapped in Fig. 7. In the 1972–73 breeding

season, 17 individuals out of 29 returned to the original nests of the rookery and after the 1972–73 season 8 re-arrivals were found. The nest sites of 25 birds are illustrated in Fig. 8 where large numerals are the number on the bands attached to the birds and small numerals are the year when the nest was occupied. Throughout five years, except for No. 0016 bird 24 out of 25 birds were found in the original colonies. No. 0016 had the nest in colony B with No. 0052 in the 1972–73 season, but in the 1974–75 season it was found in colony A. Therefore, it seems that the returned birds have the affinity to the original colony. However, although the removal from a nest to another was not found within one breeding season, the annual change of the nest sites was frequently recognized within a colony (Fig. 8).

As mentioned before, three birds were found in the other rookeries. No. 0058 and No. 0028 appeared in the Mame-zima rookery in 1972–73. No. 0028 was found again there in 1974–75 but it returned to the Ongulkalven rookery in the same season. No. 0056 returned to the Ongulkalven rookery in 1972–73 but appeared in the Rumpa rookery in 1974–75. However, it also returned to the Ongulkalven rookery within the 1974–75 season. It is interesting that No. 0056 had a nest at the marginal part of the rookery. SLADEN (1958) mentioned that the established breeders were over 4 years old. The two birds which returned to the Ongulkalven rookery seem to have become 5 years old in 1974–75 because they were non-breeders and seemed two years old in the 1971–72 season. The removal between the rookeries adjacent to each other is considered to be common but the individual number of the birds which changed their rookery was not so many that the population size of Adélie penguins in each rookery was not affected by the local removal.

In 1971–72, 16 birds, 8 pair of Adélie penguins were recognized as the established breeders. In the following season 10 birds returned to the Ongulkalven rookery. The nest site of one bird was not ascertained. 9 birds were found in their original nests. One pair (0016, 0052) kept the partnership but other 7 birds lost their partners, which have not been found in the Ongulkalven rookery until 1977. It seems that the partnership of Adélie penguin is not always so strong as expected.

In this paper the writer has described the records of the homing behavior of the marked Adélie penguin in a small rookery. The results obtained are suggestive but still insufficient to clarify the population structure of Adélie penguin. Extended and detailed population studies should be conducted in the future.

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